LEGISLATIVE ASSEMBLY OF THE NORTHWEST TERRITORIES

6TH COUNCIL, 43RD SESSION

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TABLED ON JULY 21, 1970

TABLE DOCUMENT # 1-43
Tabled on July 21, 1970

Reid, Crowther & Partners Limited

CONSULTING ENGINEERS 10350 - 124TH STREET, EDMONTON, ALBERTA • TELEPHONE 488-4411, AREA CODE 403

April 8,1970

PLEASE REFER TO FILE N.

LETTER OF TRANSMITTAL

Mr. S. W. Hancock, Director,
Department of Local Government,
Government of the Northwest Territories,
Arthur Laing Building,
Yellowknife, N.W.T.

Dear Sir:

Re: Hamlet of Pine Point

We are pleased to present herewith our preliminary report which has been prepared to review the various alternatives available to the Hamlet of Pine Point to improve their present water quality and to provide for expansion of the community to 2400 persons.

We would be prepared to meet with yourself and Hamlet representatives to review this report at your convenience.

Yours truly,

REID, CROWTHER & PARTNERS LIMITED

J. R. Tweddle

J. R. Tweddle, P. Eng.

JRT:lz

REPORT ON
WATER SUPPLY AND TREATMENT
HAMLET OF PINE POINT, N.W.T.

INTRODUCTION

This Report has been prepared at the request of the Department of Local Government of the Government of the N.W.T. to present the various alternatives available to the Hamlet of Pine Point in order to improve the present water quality and to provide an adequate supply for the community for additional expansion of the community to approximately 2400 persons.

We have not carried out an exhaustive study of the various alternatives available for water supply at this time. We have confined our study to outline the various alternatives available and their comparative costs at this time. Cost estimates based on the current level of information available are necessarily approximate and would require further review and confirmation prior to proceeding with any of the alternatives outlined. We

INTRODUCTION (continued)

feel the estimates provided will, however fulfill their purpose to provide the comparative costs necessary to assist the Hamlet Council and the Department in assessing the alternatives and selecting a course of action.

The current townsite was developed in 1963 by the Consolidated Mining and Smelting Company of Canada Ltd. (Cominco) in conjunction with the development of lead-zinc mining and milling operations some three and one-half miles northeast of the Townsite.

Since its inception the population of the Townsite has grown to 1,050 people. The Hamlet is currently dependent on the single mining industry operated by Cominco, and in fact, the majority of the services and housing have been built and operated by that Company. Recent reports indicate that the population will probably increase to 1,200 people in 1970 and to 1,600 people within three years. The population projection is for 2,400 people within ten years depending upon expansion of mining facilities.

EXISTING WATER SUPPLY FACILITIES

The present water supply and treatment facilities consist of those

EXISTING WATER SUPPLY FACILITIES (continued)

originally constructed by Cominco. The original system operated satisfactorily for the initial population of the townsite and the water quality obtained from the original wells. The system consists of the following:

a) Two wells drilled in 1968 to an approximate depth of 450 feet into a limestone formation (approximately 25 feet apart) each equipped with a 40 horsepower, 500 Igpm pump unit. These wells replaced the original 2 wells drilled in 1963 at depth of approximately 250 feet.

b) One 30,000 Imperial gallon wood stave tank for raw water storage.

c) Two five foot diameter Zeolite softeners arranged for automatic operation.

d) One 10,600 Imperial gallon wood stave tank for treated water storage.

e) Two 7-1/2 horsepower, 100 Igpm domestic supply and recirculating pumps.

f) One 50 horsepower, 500 Igpm electrically operated fire pump and one 500 Igpm fire pump operated by an industrial engine.

EXISTING WATER SUPPLY FACILITIES (continued)

The above equipment, together with auxiliary equipment required to operate the plant is housed in a 32 x 64 ft. storage area and a 12 x 18 ft. garage. An addition to house the 2 new wells was constructed to the north side of the plant in 1968.

Cominco has indicated that the capacity of the wells drilled in 1968 was in the order of 450 gpm. Recently the draw-down of the water table in the area has increased and indications are that the draw-down is still increasing. It is reported that during the last year the static level in one of the observation wells has dropped by approximately twenty feet.

The quality of the water has deteriorated noticeably since the deeper wells were put into operation. Of major significance are the changes in hardness, dissolved solids and sulphates. Test results over several years are indicated in Table 1. It is seen that the increase in the above constituents is as follows:

Hardness - from 500 ppm to 980 ppm

Soluble Solids - from 550 ppm to 1,380 ppm

Sulphates - from 165 ppm to 670 ppm

250 ppm - health limitation.

EXISTING WATER SUPPLY FACILITIES (continued)

The quality of a potable water supply is of major importance. The Canadian Recommended Drinking Water Standards outline minimum standards which are outlined in Table No. 1. Of particular concern with the current water supply at Pine Point are the recommended maximum total dissolved solids of 500 ppm, maximum total hardness of 100 ppm, maximum sulphate content of 250 ppm which are currently being exceeded. To achieve a water supply within the recommended standards it would therefore be necessary to reduce the quantity of these factors. Reduction of the hardness is a relatively simple process and can be achieved by utilizing sodium cycle ion exchange units as currently the practice at Pine Point or by utilizing the cold lime process. These processes would not lower the dissolved solids appreciably or change the sulphate content of the treated water. The reduction of sulphate and dissolved solid from the current water supply would involve a costly and intricate process.

The high dissolved solids would generally contribute unpleasant taste to the water. The sulphate content may cause cathartic or laxative effects when the concentration is over 600 ppm. Effects would be particularly noticeable with visitors to the site as tolerances to sulphate can

EXISTING WATER SUPPLY FACILITIES (continued)

generally be increased over a period of time.

It would therefore, appear that a decision will have to be made as to whether the current quality of water will be acceptable to the community.

The existing Zeolite softeners are each rated at an average flow rate of 100 Imperial gpm with a peak flow rate of 131 Imperial gpm. The output capacity of these units has been decreased due to the large increase in raw water hardness. Whereas approximately 25,000 Imperial gallons of water with a hardness of 500 ppm could be treated with each cycle prior to regeneration, now only about 12,500 Imperial gallons can be treated with the present hardness. This has meant an increased frequency of regeneration which now utilizes approximately 25 percent of the treated water. It has also been found that the present units, supposedly from the high hardness, cannot be run at rates higher than the average designed rate, and even at that rate with difficulty due to piping and binding of the media. It would appear that the 100 Imperial gpm rate would now be maintained as the maximum flow rate. The 24 hour production of each unit has been reduced from

EXISTING WATER SUPPLY FACILITIES (continued)

92,000 Imperial gallons to 58,000 Imperial gallons. This existing capacity is not sufficient for present demand.

FUTURE REQUIREMENTS

The average and peak water demands in northern areas substantially exceed those in southern communities. Experience has indicated that these demands are usually two to three times the normal demands in southern communities. This is usually as a result of one or more of three factors, namely:

a) Due to deep frost penetration in the winter, and in some instances, perma-frost, bleeding of mains and services is carried out thus increasing the consumption.

b) In the summer, due to the short season, low rainfall, the lack of loan and granular subsoil, large quantities of water are used for lawn sprinkling.

c) Unmetered service connections

The peak day demand in Pine Point occurs in the summer and the 1969 peak was estimated as 232 Imperial gallons per capita per day. The

FUTURE REQUIREMENTS (continued)

average consumption during the winter is estimated at 150 Imperial gallons per capita per day. On this basis, the supply should be capable of producing 368,000 gallons per day for a population of some 1,600 people within the next five years. For 2,400 people a water supply should be capable of providing 550,000 Imperial gallons per day.

In addition the present facilities lack sufficient storage and pumping capacity for fire fighting purposes. In May, 1966 the Fire Marshal for the Northwest Territories recommended that provision be made for a minimum of 1,500 Imperial gpm (preferably from an elevated tank) for a duration of two hours for fire flow. The minimum storage requirement to satisfy fire flow plus domestic demand would therefore, be 200,000 gallons. Systems such as the existing type lend themselves to economically providing elevated storage. Systems which are dependent on long pipelines should have more storage in the event of disruption of the supply line. It is more economic in these cases to provide ground storage or a combination of ground and elevated storage. In each of the following alternatives the type of storage was evaluated and estimated cost included.

FUTURE REQUIREMENTS (continued)

Additional pumping capacity will be required to meet the higher demands as well as to provide circulation in the water distribution system. The distribution system constructed in 1968 was designed to be circulated seperately from the system west of the existing pumphouse. This will require the addition of recirculation pumps to provide this function.

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT

Seven alternative schemes have been studied for the provision of a potable water supply and treatment system for the Townsite. While some of these do not provide a potable water of the recommended standards, these have been studied to assess the relative economics of providing a better quality of water.

The estimated costs for construction and operation are based on preliminary information. Prior to commencement of construction of any of the alternatives, a more detailed analysis of costs should be made of that particular alternative. However, on a general cost basis the preliminary estimates do provide an adequate assessment of the alternatives.

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

In each alternative an estimated operating cost was included. This cost includes any additional costs which will be incurred over and above the existing system. Where applicable, this includes additional chemical and power costs, and in Alternative 2 the cost of a full time operator was included since a permanent operator would be required. It is understood that in most instances the expansion of the distribution system will require additional maintenance and personnel time, however, this will be relatively equal in all cases.

A brief review of each alternative follows:

Alternative 1 - Expand Existing Zeolite Softening

This alternative consists of expanding the present facilities to provide a treatment capacity of 368,000 gallons per day. This system will require the development of at least one more well as a standby, the addition of two additional larger Zeolite softening units, rearrangement of the existing pumping facilities, construction of a 200,000 gallon elevated storage tank, provision of heating facilities for the elevated storage, and some modifications to the existing building to house the additional equipment. This

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

system could readily be expanded to meet the future requirement of 550,000 gallons per day be the development of additional wells and the addition of more softeners. Provision should be made for a more efficient method of storing and handling salt since on a peak day up to five tons of salt will be required.

This system will provide a potable supply which will be high in dissolved solids and sulphates since this process will only remove the temporary hardness. These constituents will remain at approximately 1300 ppm dissolved solids and 670 ppm sulphates. While dissolved solids may impart only taste to the water, cathartic effects may be experienced by some people, particularly newcomers consuming water having sulphate concentration of more than 600 ppm. These effects are increased with sodium present in the water, which is added to the water in the ion exchange process. Sodium chloride (salt) is used for regeneration of the Zeolite resin in this case.

Alternative 2 - New Lime Softening Plant

This alternative evaluates the cost of providing a cold lime-soda ash softening process. It would consist of development of an additional well,

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

provision of equipment and plant for the softening process comprising of a solids contact unit, gravity filters, recarbonator and associated equipment, a small clear well, a building to enclose the new plant and a 200,000 gallon elevated storage. Facilities for handling and storing lime and soda ash will also be provided. Over 600 tons of these chemicals will be used annually. The existing plant may be utilized for a portion of the system. Due to the need for continuous water supply, most of the existing equipment would have to remain in service during construction of new facilities. This plant could be enlarged in the future with installation of additional equipment.

This process would reduce the hardness to the desired maximum, reduce the dissolved solids by approximately 10 percent, but would not reduce the sulphates. Therefore, the same disadvantages apply as for Alternative 1.

Alternative 3 - Pipeline to Great Slave Lake - Hamlet Only

The alternative proposes the construction of a pipeline to Great Slave Lake. For the purposes of this report a route has been selected which

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

lies north easterly from the townsite to the Mill, skirting the Mill, and proceeding northerly to the Lake at a point approximately 1 mile west of Isle du Mont. Cost estimates have been based on this alignment.

A route due north from the townsite to the Lake would be approximately 2 miles shorter than the route described above. This route would, however, cross approximately 4 miles of muskeg indicated on current topographical maps. The cost of construction accross this muskeg in summer would be very expensive, however, potential savings would be anticipated on pipeline construction, if the work was carried out during the winter. Construction of the access road and power line would also have to be assessed in relation to the soil conditions.

Soundings in the Lake published by the Canadian Hydrographic Service indicate that the lake bed drops more rapidly to a suitable depth for a lake intake pipe in the vicinity of Isle du Mont. Soundings for various locations of an intake should be carried out from the ice in the spring.

Alternate routes for the pipeline would have to be located on the ground land checked for soil conditions prior to a selection of route.

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

Additionally, routes would have to be checked for confliction with potential ore bodies.

This scheme would require a lake intake, intake line, a pumphouse at the lake, and a pipeline from the lake to the Hamlet. A power line from the mine to the lake and an access road from the existing road to Dawson Landing to the pumphouse location would be required and has been included in the estimated cost.

A one million gallon ground storage reservoir would be constructed in the Hamlet and the existing pumping facilities revamped to provide necessary domestic and fire flow. The ground storage reservoir would provide approximately three days' storage initially and two days' storage in the future. Elevated storage would not be required with provision of adequate fire pumps.

It is expected that the water obtained from the lake would be of good quality and would not require treatment. The quality of the water would, however, need to be confirmed by sampling, particularly at the spring runoff. Hay River does have turbidity removal equipment because

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

the intake is located in the vicinty of Hay River outlet.

Alternative 4 - Pipeline to Great Slave Lake to Serve Town and Mine

This alternative proposes the construction of a pipeline and pumping facilites capable of supplying the Townsite and Pine Point Mines with water. This alternative is considered because Pine Point Mines uses a large quantity of water and the pipeline as outlined in Alternative 3 would be adjacent to the Mine making a common supply system economical. Coupled with this the Mine uses similar water and requires softening for their process. An analysis of the Mine water is included in Table 1.

This alternative would be feasible only if Cominco would purchase the water from the system at the cost of production, that is, the amortized capital cost plus operating costs. In fact, the Mine may find this more economic than producing and treating water with their present facilities. Although, no detailed costs are available from Cominco, it is estimated that the cost would be approximately 60 to 75 cents per thousand gallons for their water supply if all the water required for the process is treated. If no treatment of the lake water is required, the cost of water from the lake source will be

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

considerably less than for the well supply.

The facilities for this alternative would basically consist of the same system as provided for Alternative 3. In addition a one million gallon storage reservoir providing two-thirds of the daily Mine consumption would be provided at the Mine and the water repumped from this reservoir to the Townsite. The reservoir would provide for peak demands by the Mine and the Town while a pipeline would operate on a more uniform delivery rate. The intake, intake line, pumphouse and the line from the Lake to the Mine would be increased in size to allow for the increased demond. The facilities at the Town would remain the same as in Alternative 3.

The main advantage to combining a water supply to Cominco and the Townsite would be a lower unit rate for the water for both the Town and the Mine.

Alternative 5 - Supply from Current Mine Source

This alternative proposes obtaining a water supply from the Mine facilities. This alternative assumes that Cominco can produce a potable water supply for the Town with their facilities at the Mine. As mentioned

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

previously Cominco have a softening treatment plant at the Mill for their process water. While it is uncertain as to whether there is sufficient well or plant capacity to supply the Town from the existing Mill source, it is felt that this alternative merited preliminary investigation.

While Cominco presumably obtain their source from a similar aquifer as the Town, the hardness, dissolved solids and sulphates are considerably lower than the Town's supply at the present time. With softening, the hardness, dissolved solids and sulphates, contents of the water would be within tolerable limits.

This system would include a small reservoir and pumphouse at the Mine, a pipeline from the Mill to the Town, a one million gallon reservoir and other facilities similar to Alternatives 3 and 4.

Alternative 6 - New Surface Water Source

The development of wells in an aquifer recharged from surface water could be considered, although there would be a distinct possibility that such a source within an economical distance of the Pine Point townsite

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

would be disrupted by additional open pit mining in the area at some time in the future.

Preliminary discussion with a specialist in this field indicate that there is a possibility of developing a source of this type, however, a detailed investigation would have to be carried out including test drilling which is estimated to cost in the order of $20,000.

To compare this alternative we have prepared estimates based on a source within 3 miles of the townsite, wells, access road, power line and, one million gallons storage at the townsite.

Alternative 7 - Demineralization of existing source

This alternative proposes de-mineralization of the existing water supply to remove dissolved solids and sulphates as well as hardness to the recommended maximum level. During recent years several processes have been developed for de-mineralizing water, some of which are electrodialysis, reverse osmosis and ion exchange resins. The estimated cost is based upon the new ion exchange resin utilizing the sulphate-bisulphate cycle as developed by the Nalco Chemical Company.

ALTERNATIVES FOR WATER SUPPLY AND TREATMENT (continued)

The system would include the process equipment, a building to house the equipment, revamping the existing pumping facilities, development with one additional well and an elevated storage reservoir.

ESTIMATED COSTS

The estimated costs for the alternatives are summarized in Table II. The costs have been based upon anticipated construction costs in the northern areas.

Table II gives the capital expenditure required for each alternative and the amortized costs of each capital expenditure over 25 years at eight percent. To this the additional operating costs have been added to give an annual cost for each alternative.

The total annual cost was then divided by the expected annual demand over the next five years. In addition, the average cost per 1,000 gallons was calculated on the system capability of producing water. It is this figure that is more significant since it represents the unit cost of water production based on plant capacity. In some instances, such as the pipe-

ESTIMATED COSTS (continued)

lines to the lake, the cost of equipment for ultimate demand was used since duplication of smaller facilities would be much more costly than increasing the capacity at this time.

SUMMARY AND CONCLUSIONS

It is evident that a decision is required as to whether the current quality of water with respect to total dissolved solids and sulphate content will be acceptable to the community. A valid prediction as to whether the quality of the water from the wells now in use will improve or deteriorate is not possible in view of the uncertainties of well supplies and effects of current and potential mining operations in the area.

Should it be decided that the high concentration of dissolved solids and sulphate can be accepted in the community, the existing plant could be expanded utilizing zeolite softening at the least capital cost as outlined under Alternative No. 1. The indicated unit cost of water produced from this source is $0.46 per 1,000 gallons.

The other two alternatives considered to utilize the current well source of water are the new Lime Softening Plant as described in Alternate

SUMMARY AND CONCLUSIONS (continued)

No. 2 and Alternate No. 7, the demineralization process. These alternatives involve high capital costs and unit costs for production being $1.48 and $1.65 per 1000 gallons respectively.

If it is decided that a different source of water should be utilized, the most economical alternative is the pipeline to the Great Slave Lake to serve both the mill and the townsite. The unit cost to provide water by this method is estimated to be $0.38 per 1,000 gallons. The participation of Cominco as operators of the mill would be required to make this alternative feasible.

Alternative No. 3 - the pipeline to Great Slave Lake to serve the townsite only is worthy of consideration. It is noted that the initial unit cost is relatively high at $1.50 per 1,000 gallons at the demand for 1600 persons. The unit cost would be reduced to approximately $0.75 per 1000 gallons when the population reached 2400 persons.

The development of wells in an aquifer recharged from surface water as described in Alternative No. 6 is potentially relatively cheap, the unit cost being estimated at $0.60 per 1,000 gallons. However, this alternative

SUMMARY AND CONCLUSIONS (continued)

could only be considered if it were established that an area existed which would be immune to potential mining activity.

The supply of the townsite from the current Mill source as described in Alternative No. 5 would result in a unit cost of approximately $1.13 per 1000 gallons. This alternative could only be justified as a first stage of construction of the pipeline to Great Slave Lake to serve both the Mill and the townsite. The unit cost would then reduce to $0.38 per 1000 gallons when the system is completed.

In summary, we would recommend the following at this time:

1) That the acceptability of the current water source be considered in view of the high concentration of dissolved solids and sulphate.

2) That consideration be given to providing a common supply from Great Slave Lake to supply both Pine Point Mines and the Townsite. This would require confirmation that Cominco would be interested in establishing such a system. Although this alternative requires the highest capital cost it is potentially the most economical solution and would solve the sulphate and dissolved solids problem.

SUMMARY AND CONCLUSIONS (continued)

3) Additional field work should be carried out prior to break-up on Great Slave Lake to obtain soundings and water samples at possible Great Slave Lake intake sites.

TABLE No. 1

RAW WATER ANALYSIS

Item	Public Health Engineering Mar. 17/65	University of Alberta Apr. 28/67	Public Health Engineering May 9/69	Alchem Dec./69	Mine Aug. 21/69	Public Health Engineering Mar. 13/69	Canadian Drinking Water Recommended Maximum
Dissolved solids	552	1078	1380	1300		1480	500
Suspended solids			--	70			
Total Hardness as $CaCO_3$	80*	600	983.7	960	772	1020	100
Calcium Hardness			551.2	540	488		
Magnesium Hardness			--	420			
Phenolphthalein Alkalinity	Nil		Nil	Nil	0.0	Nil	15
Total Alkalinity as $CaCO_3$	284	281	322.7	310	284	300	400
pH	7.8		8.1	7.6	7.9	7.5	
Chloride Cl	4.0	12	16.3		11.6	18.0	250
Chloride as NaCl				4			
Sulphate SO_4	165.0	339	640	675	471	708.4	250
Sulphate as Na_2SO_4				1150			
Calcium	20.8		220.5		179	237.4	
Magnesium	6.8		105		78.9	103.8	125
Sodium	177.4		34.48		13.3	20.3	
Carbonate	--		--		0.0	Nil	
Bicarbonate	170.4		193.6		346	180	
Nitrate	0.1		0.13		0.00	0.9	
Fluoride	0.82		0.72			0.69	1.5
Nitrate Nitrogen	0.03	Nil	0.03			0.21	
Nitrite Nitrogen	0.00	Nil	--			N.D.	
Free Ammonia	0.52		0.01			0.04	0.3
Iron	N.D.	0.07		Nil	0.15	7.68	0.1
Color	5.0		10	--	5.	5.0 Less	[illegible]
Turbidity	0.3		3.5	--	17	51.0	
Lead	0.02				0.020		0.05

* Not consistent with other results which indicate hardness ± 500

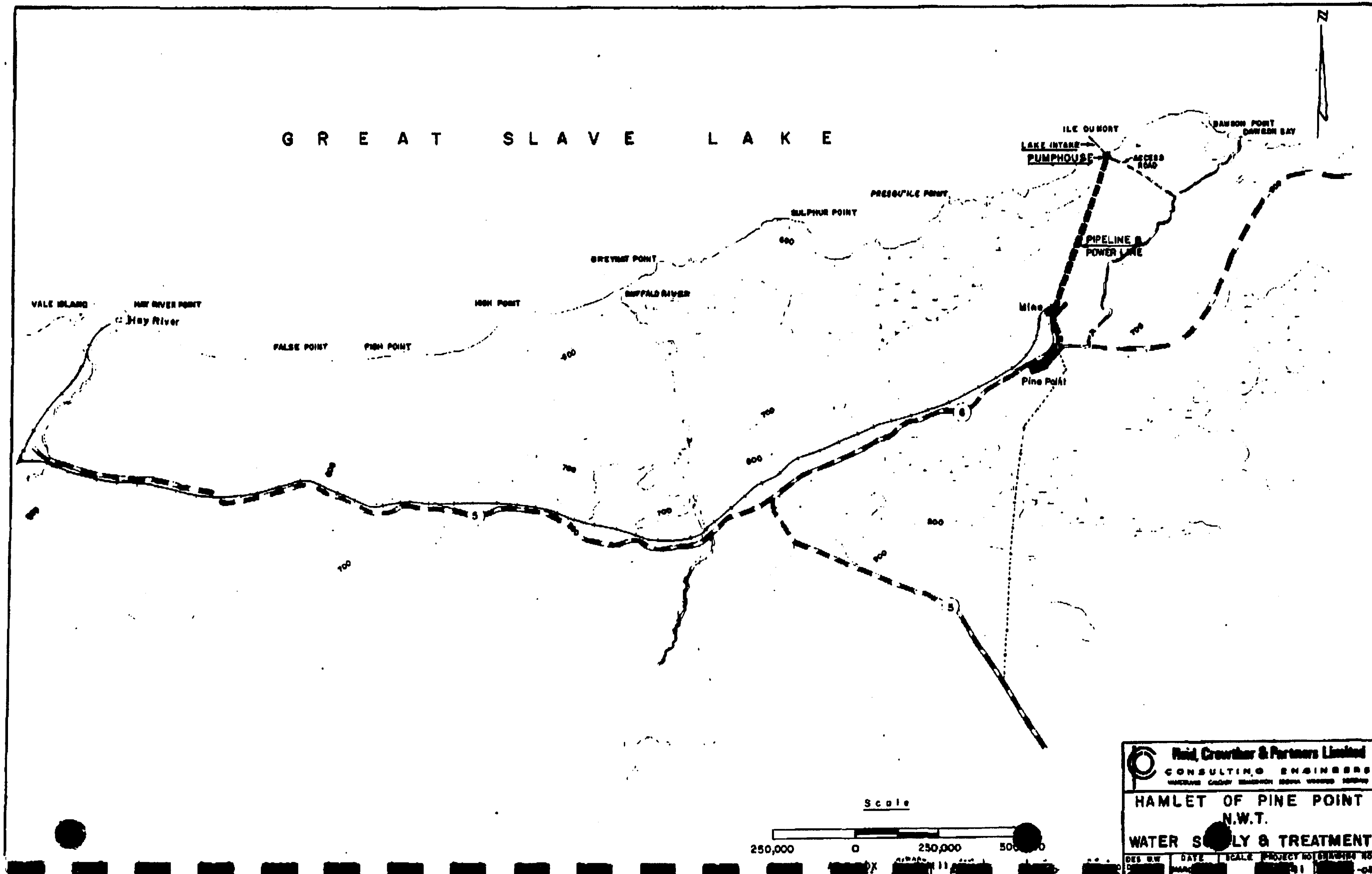
TABLE No. 2

HAMLET OF PINE POINT

WATER SUPPLY AND TREATMENT

COST SUMMARY

Alternative	Average Annual Demand Mil.gal.	Capacity Mil.gal.	Capital Cost	Amortized Cost /25 yr @8%	Power, Chem. Other Extra Costs @ Demand	Total Annual Cost @ Annual Demand	Average Cost 1,000 gal. @ Annual Demand
1. Expansion of existing facilities, Zeolite softeners	100	134	$350,000	$ 32,788	$ 13,400.	$46,188.	$0.462
2. Provide new Lime softening plant	100	134	625,000.	58,549.	89,438.	147,987.	1.48
3. Pipeline to Great Slave Slave Lake for Town only	100	200	1,525,000	142,860.	7,840.	150,700.	1.50
4. Pipeline to Great Slave Lake incl. service to Pine Point Mines	647.5	747.5	2,300,000.	215,462.	32,415.	247,877.	0.383
5. Mine Supply Townsite	100	200	550,000.	51,523	61,565.	113,088.	1.13
6. Develop new subsurface supply within 3 miles of Townsite	100	134	620,000.	58,080.	2,000.	60,080.	0.60
7. Demineralization Existing supply	100	150	734,000.	68,760.	96,400.	165,160.	1.65



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GREAT SLAVE LAKE
ILE DU MORT
DAWSON POINT
DAWSON BAY
LAKE INTAKE
PUMPHOUSE
ACCESS ROAD
PRESQU'ILE POINT
SULPHUR POINT
PIPELINE &
POWER LINE
BREYNAT POINT
BUFFALO RIVER
VALE ISLAND
HAY RIVER POINT
Hay River
HIGH POINT
FALSE POINT
FISH POINT
Mine
Pine Point
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Reid, Crowther & Partners Limited
CONSULTING ENGINEERS
HAMLET OF PINE POINT
N.W.T.
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PROJECT NO
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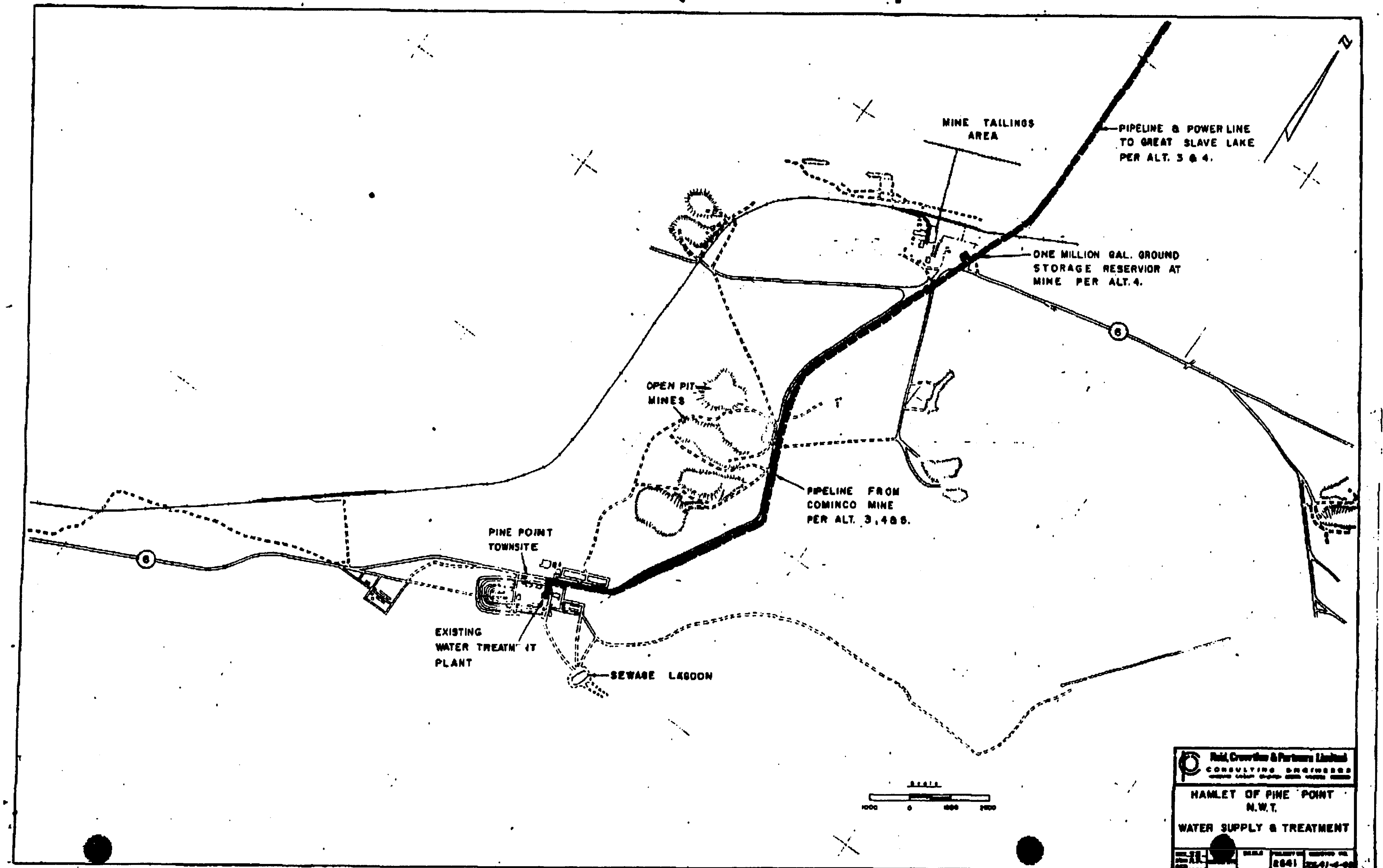
MINE TAILINGS AREA
PIPELINE & POWER LINE TO GREAT SLAVE LAKE PER ALT. 3 & 4.
ONE MILLION GAL. GROUND STORAGE RESERVIOR AT MINE PER ALT. 4.
6
OPEN PIT MINES
PIPELINE FROM COMINCO MINE PER ALT. 3, 4 & 5.
PINE POINT TOWNSITE
6
EXISTING WATER TREATMENT PLANT
SEWAGE LAGOON
CONSULTING ENGINEERS
HAMLET OF PINE POINT N.W.T.
WATER SUPPLY & TREATMENT
2641